



Enhancing the Use of Value-Added Products from Underutilized Fruit of the Endangered Mabolo (*Diospyros blancoi*) Tree

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Abstract Mabolo fruit is from an endangered Mabolo tree in the Philippines. It is an ideal source of calcium, vitamin B, iron and protein and contains numerous phenolic compounds that provide powerful antioxidants. It is nutritious but it is underutilized as human food because of its unpleasant odor comparable to rotten cheese or cat feces and is covered with hair which is irritating to sensitive skin. Because of this, it got rotten, eaten by the birds, used as feeds to domestic animals and some were thrown as garbage. This study aimed to produce Mabolo Cake, Mabolo Boat Tart, Mabolo Fritters and Mabolo Pancake, and to determine their acceptability; to promote the nutritious products to the community; to introduce them to the entrepreneurs; and to encourage everybody to have in their snack boxes the value-added Mabolo products. This is an experimental study utilizing the five-point Hedonic scale in assessing the acceptability of the products in six sensory attributes; appearance, texture, odor, taste and overall liking. The products were assessed by twenty-five panelists. It was found out that Mabolo Cake and Boat Tart ranked first and second respectively in six sensory attributes, with a rating within the range of Like Very Much while Pancake ranked third with a descriptive rating of Like in all attributes. Fritters ranked fourth in all attributes with descriptive rating of Like in appearance and taste and Neither Like nor Dislike in Texture, Odor and Overall Liking. It can be concluded that the products are generally acceptable. Proper promotion of Mabolo products can on one hand provide useful livelihood source while in the other hand provide incentive for communities for protecting the endangered tree.

Keywords mabolo tree, mabolo cake, mabolo boat tart, mabolo fritters, mabolo pancake, hedonic scale sheet

INTRODUCTION

Mabolo (*Diospyros blancoi*) is an evergreen forest tree that belongs to the *Ebenaceae* (Ebony) family. In the Philippines, it is commonly identified by its wood locally known as *Kamagong*. Because it is iron-like and nearly unbreakable, *Kamagong* is popularly called “iron-wood” and is often used for furniture and carved into hair combs and knife handles (Bilton, 2012).

Like Narra and Molave, *Kamagong* is a premium wood. It is protected by Philippine laws by regulating its extraction from the forest through a Special Private Land Timber Permit issued only by the Secretary of the Department of Environment and Natural Resources (DENR, 1990). Its economic value however undermines such regulation so that by 2007, DENR issued Administrative Order No. 01 declaring Mabolo Tree/*Kamagong* as one of the critically endangered species.

Mabolo bears fruit that is about the size of an apple. Its skin that turns into purple or maroon when ripe is covered with hair. Its seeds are contained in its pulp.

The fruit itself lacks sweetness and is rather dry. However, it is highly nutritious. It is an ideal source of calcium, vitamin B, iron, and protein. Research shows that it “contains numerous phenolic compounds that provide powerful antioxidants (Alvarez, 2012).”

The pulp of the Mabolo fruit emits a strong cheesy odor when opened thus, while bats, birds and domestic animals feed on it, humans shy away from its foul odor leaving it to rot and be

thrown away. This makes Mabolo fruit unpopular and underutilized for human consumption despite its rich nutritive value.

It is in this context that the researcher was inspired to discover recipes using Mabolo fruit. Acceptable Mabolo food products will lead to the utilization of the fruit as ingredient of human food thereby increasing its economic value. This will in turn encourage protection and propagation of the tree that has been mainly cut down for furniture or ornamental use of its wood.

Producing value-added food products from the underutilized fruit of the endangered Mabolo tree reinforces the implementation of the Forestry Laws of the Philippines. Specifically, it supports Presidential Decree No. 705 that calls for the “protection, rehabilitation and development of forest lands” to ensure continuity of productivity. Mabolo fruit food items could encourage locals to utilize Mabolo fruits instead of its wood as an alternative source of livelihood and thereby preserve and protect Mabolo trees. Likewise, this study generally supports the 1987 Philippine Constitution. The use of Mabolo fruit as an ingredient to food products that become additional food items and the bases for manufacturing and production directly responds to Section 10 Article 14 that encourages and prioritizes research and development for the country’s “productive and national life (Nolledo, 2009).”

As a development of food recipe, this study involves fortification or enrichment process which the Food and Agricultural Organization (FAO) of the United Nations define as “the addition of one or more essential nutrients to a food whether or not it is normally contained in the food (Codex Alimentarius, 1991).” The addition of shredded Mabolo fruit to the basic cake and pancake recipes; putting Mabolo filling to tart; and making fritters from Mabolo fruit increase nutrients and therefore enhances the value of the food products.

The researcher fully believed that this study can significantly benefit the following:

Mabolo Growers. The findings of this study will make them realize that food products aside from wood can be a source of income from Mabolo trees. This will refrain them from cutting and encourage them to grow more Mabolo trees.

Community. Mabolo fruit products which are highly nutritious are good additional items to the people’s snack or meal.

Entrepreneurs. This study provides them with the recipe of the value-added products of Mabolo fruit. It could enable them to mass produce new food items for another income.

Bureau of Forestry and the Department of Environment and Natural Resources of the Philippines. As Filipinos could potentially be encouraged to protect and propagate Mabolo tree in their locality, this study will support these two Philippine government agencies in enforcing the law to protect the endangered Mabolo tree.

Food Technology Teachers and Students. The results of the study will inspire them to continue to experiment and come up with more recipes utilizing Mabolo fruit.

OBJECTIVES

The study aimed to determine the acceptability of the value-added products of Mabolo fruit developed at Bohol Island State University, Main Campus, Tagbilaran City, Bohol, Philippines for Academic Year 2011-2012. It also aimed to introduce the food items from the seemingly worthless Mabolo fruit to the community, to entrepreneurs and to consumers in general.

METHODOLOGY

This study used experimental method in formulating the recipes. After perfecting the recipes, the finished products were subjected to sensory appraisal which is the scientific method to evoke, measure, analyze and interpret reaction to those characteristics of food materials as they are perceived by the senses of sight, smell, taste, touch and hearing. In this study the finished products were evaluated by the panelists using the five point Hedonic scale sheet.

This study was conducted in the Food Technology Laboratory of Bohol Island State University Main Campus, Tagbilaran City. Twenty five individuals who were chosen through

purposive sampling were the panelists/participants of this study. They were the fifteen third year students from Bachelor of Science in Industrial Technology who come from rural communities, the five Food Technology instructors and the five Food Technology graduates who are now practicing their craft in rural communities. They were selected because of their expertise in food preparation and processing. The researcher used the 5-point Hedonic Scale comprising – 5- Like Very Much, 4- Like, 3 Neither Like nor Dislike, 2 Dislike and 1- Dislike Very Much was constructed based on the work of Gatchalian et al. (2009). It was pilot tested to the second year Food Technology students who were not the actual panelists of the study. After making the necessary improvement, it was then finalized and reproduced for the purpose of the study.

After recipes utilizing Mabolo fruit were perfected, they were prepared and food products were subjected to evaluation in three trials. The first trial was done right after cooking while the products were still hot; the second was in the afternoon when the products were already cold and the third was in the following morning. Different trial times were intended to identify possible change in the ratings of participants. The Hedonic scale was used in the evaluation. The weighted mean derived from the assigned numerical and descriptive ratings was the basis of analysis.

Table 1 Range used to evaluate Mabolo food products

Numerical Ratings	Description
4.50-5.00	Like Very Much
3.50-4.49	Like
2.50-3.49	Neither Like nor Dislike
1.50-2.49	Dislike
1.00-1.49	Dislike Very Much

Source: The range is adopted from the 5-point Hedonic Scale of M. Gatchalian.

Table 2 Mabolo fruit Products and Recipes

Name of Product	Recipe
Mabolo Cake	Beat 2 pieces eggs; add $\frac{1}{4}$ cup oil and $\frac{3}{4}$ cup sugar. Blend the mixture for 30 seconds. Mix together 1 cup all purpose flour, $\frac{1}{2}$ teaspoon baking soda and 2 teaspoons baking powder. Add the mixed dry ingredients to the egg mixture then add $\frac{1}{4}$ cup evaporated milk and the 1 cup shredded mature Mabolo fruit and blend well. Add 1 teaspoon vanilla. Pour the mixture into a well-greased 31/2x9x3 inches loaf pan. Bake at 350 degrees Celsius until done. Remove from oven and allow to cool. Slice and serve.
Mabolo Boat Tart	Tart filling: In a bowl, mix together 1 big can condensed milk, 1 cup all purpose flour, 1 teaspoon vanilla, 1 piece egg, 1 cup shredded Mabolo fruit, $\frac{1}{4}$ cup peanuts and $\frac{1}{4}$ butter. Mix well and cook in a double boiler until mixture spreads consistently. When done, remove from fire and allow to cool. Set aside. Crust: Cream 1 cup butter until floppy. Add $\frac{1}{4}$ cup butter until floppy. Add $\frac{1}{4}$ cup sugar and 1 piece egg, beat well. Add 1 cup flour and mix well. Mold in well-greased tart shell molder. Bake until done. Fill the crust with tart filling. Wrap in colored cellophane.
Mabolo Fritters	Cut mature Mabolo fruit into serving pieces about 1/3 inch thick. Slightly dust the fruit with flour. To make the batter, sift 2 cups flour, $\frac{1}{4}$ cup sugar and 1 cup water and beat to form a smooth batter. Stream before using. Dip fruit into batter and fry in hot oil until golden brown. Drain excess oil. Arrange on serving platter. Sprinkle with sugar.
Mabolo Pancake	Sift together 2 cups flour, 1 teaspoon salt and 2 teaspoons baking powder. Beat 2 pieces eggs and add to flour mixture. Mix 1 cup evaporated milk, flour mixtures and $\frac{1}{2}$ cup butter. Add three cups shredded mature Mabolo fruit and blend. Pour 1/2 cup of mixture into a shallow pan brushed with oil. Pan-fry until golden brown. Serve with syrup or honey.

**Perfected recipes after several trials conducted by the researcher in the university laboratory.*

RESULTS AND DISCUSSION

Acceptability of food is usually based on sensory attributes such as appearance, texture, odor, taste, and overall liking. Appearance attribute includes color, size and shape. Texture covers the feel and touch sensation and the viscosity and consistency of the product. On the other hand, the odor refers to the smell while the taste refers to sweetness, bitterness, sourness, and saltiness of the snack item. In this study, Mabolo snack products were assessed based on the cited five sensory attributes.

First sensory evaluation result

The results of the first sensory evaluation show that Mabolo Boat Tart was rated highest in appearance and texture liking at 4.75 and 4.78 respectively. Both ratings have the qualitative description of Like Very Much. This is favorably influenced by the boat-like shape of the crust of the Tart and its crunchiness and flakiness that caught the attention of the panelists.

Mabolo Cake was rated highest in odor and taste attributes at 4.86 and 4.56 respectively. Both have the qualitative description of Like Very Much. Odor and Taste sensations are the attributes of flavor which determine the acceptance or rejection of a food product (Gatchalian, 2009). In this study therefore, Mabolo Cake is highly acceptable in flavor.

Among the food products, Mabolo Fritters is rated relatively lowest in all sensory attributes. However, all the rates have the corresponding qualitative description of Like while its Overall liking is Neither Like nor Dislike. This makes the fritters still generally acceptable.

The first sensory evaluation was carried out right after production of the food items.

Second sensory evaluation result

Results of the second sensory evaluation reveal that Mabolo Cake has the highest rates in texture, odor and taste attributes while Boat Tart is rated highest in appearance and overall liking. Consistent with the first evaluation, Mabolo Pancake and Mabolo Fritters were rated third and fourth, respectively in all sensory attributes both with the qualitative description of Like.

This evaluation was done after the food items were allowed to cool.

Third sensory evaluation result

Third evaluation results identify Mabolo Cake being rated highest in appearance. This could be favorably brought about by the enhanced appearance of the cake that attracted the panelists due to the shredded Mabolo fruit grains that became noticeable when the product was allowed to cool. Overnight, the good taste developed while the texture remained soft so that the cake was likewise rated highest in texture and taste liking. Meanwhile, Mabolo Tart was relatively rated highest only in odor attribute at 4.28.

Of the four products, Mabolo Fritter has the least rate in five sensory attributes. It has an overall qualitative rating of Neither Like nor Dislike which may be brought about by the appearance, texture and odor of the product after one day. Upon examination, the product shrank, became crumbly; the odor of the Mabolo fruit became noticeable and the taste changed as the oil started to appear in the surface.

Overall result of the three sensory evaluations

Putting together the results of the three evaluations, Mabolo Cake consistently ranked first, followed by Mabolo Boat Tart, then Mabolo Pancake and Mabolo Fritters. None of the four value-added Mabolo products were rated Dislike or Dislike Very Much.

Table 3 Overall rating of the three sensory evaluations

Product	Evaluation			Overall Rating	Description	Rank
	1 st	2 nd	3 rd			
Appearance Liking						
Mabolo Cake	4.57	4.8	4.88	4.75	Like Very Much	1
Mabolo Boat Tart	4.75	4.87	4.6	4.74	Like Very Much	2
Mabolo Fritters	4.0	4.0	3.16	3.72	Like	4
Mabolo Pancake	4.0	4.16	4.16	4.11	Like	3
Texture Liking						
Mabolo Cake	4.17	4.14	5.0	4.44	Like	1
Mabolo Boat Tart	4.78	4.13	4.0	4.30	Like	2
Mabolo Fritters	3.80	3.6	3.0	3.46	Like	4
Mabolo Pancake	4.00	3.8	4.0	3.93	Like	3
Odor Liking						
Mabolo Cake	4.86	4.75	4.0	4.54	Like Very Much	1
Mabolo Boat Tart	4.29	4.6	4.28	4.39	Like	2
Mabolo Fritters	3.63	3.83	3.0	3.49	Neither Like Nor Dislike	4
Mabolo Pancake	4.02	4.17	4.0	4.06	Like	3
Taste Liking						
Mabolo Cake	4.56	4.56	5.0	4.71	Like Very Much	1
Mabolo Boat Tart	4.5	4.43	4.14	4.36	Like	2
Mabolo Fritters	3.8	3.75	3.0	3.51	Like	4
Mabolo Pancake	4.0	4.0	4.0	4.0	Like	3
Overall Liking						
Mabolo Cake	4.88	4.5	4.13	4.50	Like Very Much	1
Mabolo Boat Tart	4.67	4.57	4.25	4.49	Like Very Much	2
Mabolo Fritters	3.6	3.75	3.0	3.45	Neither Like Nor Dislike	4
Mabolo Pancake	4.17	4.25	4.0	4.14	Like Very Much	3

Shelf life

Samples of the products were allowed to stand at room temperature to observe the changes that may take place. Fritters and Pancake were observed to have oil appearing on the surface on the second day but they were still edible. On the third day, they were already watery and should be discarded as molds began to appear. The cake on the other hand, had changes on the third day as the texture began to soften and molds appeared on the fourth day which makes it unfit for human consumption. Only Boat Tart survived until the seventh day.

Boat Tart thus ranked first in shelf life as it lasted for seven days. It was followed by cakes, pancakes and fritters which can only be eaten safely until the second day. However, remedy can be done in cake since it can still be toasted to last for a little longer and can be stored for future use.

Marketability

The four value-added products from Mabolo were displayed at the school cafeteria of Bohol island State University Main Campus for sale. It was observed that in one week's display of the products, cakes, pancakes fritters and boat tarts were all sold. It was noted that the product were saleable among people of all ages since the products were bought by faculty members and college and high school students. Fritters and pancakes were the favorites of high school students while it was observed that faculty members ordered cake and boat tart as their present for their children and loved ones.

CONCLUSION

Mabolo fruit can be eaten by any person without noticing its unpleasant smell. Its foul cheesy odor can be dissipated by removing the skin and by processing it adequately. It can therefore be fully utilized as food for humans and not only as animal feeds.

Snack items from Mabolo fruit were generally acceptable and they can be made more nutritious with other flavorings.

It is recommended that dissemination of this study be done to promote the use of Mabolo fruit for food items. This should specifically be introduced as an alternative source of livelihood in the rural community where Mabolo trees are still found in substantial number. The snack items are nutritious and easy to prepare. Mabolo Cake and Mabolo Boat Tart can be cooked with the use of native or clay oven while fritters and pancake can be cooked using frying pan or *carajay* which are the commonly used kitchen equipment and utensil in those areas.

This study should also be disseminated to entrepreneurs. The nutritive value and availability of fruit supply could convince them to mass produce the food items for commercial purposes.

Finally, food technologists should be informed of this study to inspire them to conduct experiment for other products that could be derived from Mabolo fruit.

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